

Your Brain on Ice

Cooling the body after stroke
or cardiac arrest can save
precious brain function.

BY JAMIE TALAN

Stephen Michalski, M.D., was a general surgeon in private practice in New York City when he awoke one morning in 2007 with chest pain. He drove to Albert Einstein College of Medicine, where he often performed surgery. Moments after he gave his vital statistics to the emergency room staff, Dr. Michalski went into cardiac arrest.

It took 25 minutes to restart his heart. They rushed him into surgery and placed a stent in one of his arteries to encourage blood flow. Dr. Michalski was unconscious for 25 minutes without a beating heart, a length of time that often results in irreparable brain damage. Following the cardiac stenting procedure, he was transferred to the intensive care unit. Things looked bleak.

A neurologist called to his bedside noted Dr. Michalski's posture: His toes were solid like rock and pointing up—not a good sign. Then Brigitte Bendixen, M.D., remembered that a few miles south at Columbia Presbyterian Medical Center, a doctor named Stephan Mayer, M.D., had established a protocol for cooling the body to protect brain function in cases of sudden cardiac arrest. Dr. Bendixen called Columbia Presbyterian and requested a transfer. It took eight more critical hours before Dr. Michalski arrived in the Neurointensive Care Unit.

Dr. Mayer had already prepared his cooling unit for the surgeon, who was in grave condition when they placed his comatose body into a hypothermia system. The protocol called for 24 hours of cooling and another two days of warming his body back to normal. Throughout the whole process, Dr. Michalski breathed on life support and was kept in a drug-induced coma. He didn't wake up for a week.

PREVENTING BRAIN DAMAGE

Dr. Mayer had already witnessed the benefits of cooling. Since 2004, when he opened a hypothermia unit for such cases, he had seen dozens of people in the throes of sudden cardiac arrest escape brain damage and walk out of the intensive care unit and back into their worlds. Strong evidence now exists that cooling the brain after sudden cardiac arrest or stroke minimizes brain damage by protecting brain cells from injury and death.

Each year approximately 250,000 people in the U.S. die of sudden cardiac arrest, in which the heart loses its rhythm, stops pumping blood, and enters into pulseless electrical activity, called ventricular fibrillation. Most of these people die on the spot. Even if emergency medical services arrives quickly and successfully resuscitates the patient—which happens

as little as 20 percent of the time—there remains an 80 to 90 percent chance of severe, irreversible brain damage.

In a study published in 2004 in the *New England Journal of Medicine*, only five percent of out-of-hospital cardiac arrest patients were successfully resuscitated and survived to hospital discharge. The numbers are getting better, but the outlook for these patients has historically been viewed as grim, Dr. Mayer notes.

He shares these sobering statistics with the families of the patients who undergo cooling. What he says outside of the earshot of the family is another story.

“What if I told you that there is a treatment that can make the chances of a good recovery from ventricular fibrillation as high as 40 percent?” Dr. Mayer asks. “Of course you'd want it. Yet we currently have this disconnect where most people who suffer the unimaginable—and then are fortunate enough to be successfully resuscitated—do not get this treatment.”

Dr. Mayer first heard about cooling for sudden cardiac arrest from two studies published in 2002 in the *New England Journal of Medicine*. In the larger trial, conducted in Europe, 75 of 136 patients (55 percent) resuscitated from cardiac arrest due to ventricular fibrillation had a favorable neurological outcome with the cooling treatment. In comparison, 55 of 137 patients (39 percent) had a favorable outcome with standard supportive care alone. Standard care includes reviving the patient and keeping his or her blood pressure and heart rhythm in a normal range. A smaller single-center study from Australia showed similar results.

On the heels of the paper, the American Heart Association and the International Liaison Committee on Resuscitation agreed that medical teams ought to be cooling the body following sudden cardiac arrest.

Still, brain cooling after trauma remains controversial. While there may be potential benefits to hypothermia, says Eugene Fu, M.D., associate professor of clinical anesthesiology at the University of Miami, the risk for unwanted effects does exist. Hypothermia can expose people to infections and bleeding; and for those with heart disease, it can worsen myocardial ischemia, Dr. Fu observes.

Furthermore, although hypothermia has been studied for decades, no large, multi-center studies have established standard treatment guidelines. Of the studies that have been done, there has been little consistency on when patients were cooled, how much they were cooled, or whether they were given adjunct therapies, says Naomi Kleitman, Ph.D., a program director at the National Institute of Neurological Disorders and Stroke.

Doctors may have to rethink what they have been taught about the oxygen-starved brain.

While there may be benefits to brain cooling, the treatment can expose patients to **infections and bleeding**.

“You can draw the conclusion from the literature that hypothermia has real potential, but it’s still unproven,” Dr. Kleitman says. “That potential will depend on demonstrating how the techniques should best be administered so that you can consistently expect to have a benefit.” She says studies should define criteria for timing of hypothermia, duration, extent of cooling, speed of cooling, and procedure for re-warming.

Dr. Mayer, who runs the neurological intensive care unit at Columbia, began selling the story to his own hospital. At first, he says, “It was like pulling teeth to get the emergency room doctors and neurologists to do this. All I said was: Call me.” In 2006, he says, they had changed enough minds that his unit went from cooling a handful of patients a year to almost 20 patients in 2008.

A GRASSROOTS CAMPAIGN

Knowledge of the procedure has spread by word of mouth. A young doctor in San Francisco who was familiar with the cooling treatment had an uncle, a professor at Columbia, who collapsed during exercise. He was brought to a hospital 30 blocks away but spent 20 minutes without a pulse. Normally the brain deprived of oxygen for that length of time suffers a severe assault.

She called Dr. Mayer and asked for her uncle to be transferred. A week later, the 58-year-old professor was talking.

When Dr. Mayer tells this story, he also recalls the deep sadness that filled a room five doors down from this patient. A 34-year-old father of two small children had an asthma attack that led to respiratory and then cardiac arrest. He ended up brain dead.

“I don’t know whether cooling would have saved him,” Dr. Mayer says, “but he never had the chance to find out.”

Stephen Michalski’s arrival at the cooling unit was also a matter of luck. Five days later, he was responding to his wife’s voice. At first, Dr. Michalski didn’t remember who he was or what his relationships were to the people around him. But his wife Diane remembers the day that she asked, “Who am I to you?” And he answered, “Burden.”

“I knew his sense of humor was intact,” Diane says. He now reads the paper, goes to the gym, and even drives. He has not, however, returned to work as a surgeon. Dr. Michalski still suffers from significant impairment and has large gaps in his memory. But, Diane says, “This procedure saved his life and saved him.”

Throughout Europe, cooling has become the standard of care for people in cardiac arrest. In the U.S., it has been slow to catch on. “It’s new and different, and it is taking a grassroots movement to spread the word,” says Dr. Mayer. “It’s a complete hit or miss, depending on where you live and where the ambulance takes you.”

A NEW ERA IN RESUSCITATION?

Hypothermia treatment was tried in the 1940s and ’50s but was abandoned because it proved too dangerous to cool the body eight degrees below normal. In this physiological state, blood pressure drops, the heart becomes stressed, and the immune system is suppressed. But advances in critical care medicine have made it possible to cool the body more safely.

Hypothermia has also been used as an experimental therapy for spinal cord injury, traumatic brain injury, excision of tumors, and even to save premature babies from brain complications. According to W. Dalton Dietrich, Ph.D., scientific director of the Miami Project to Cure Paralysis, when done soon after the injury, cooling is thought to inhibit many of the inflammatory cascades that lead to cell death and neurological dysfunction.

“It’s a powerful way to decrease those injury cascades and improve outcome,” Dr. Dietrich says. “By reducing temperatures, many of these cell injury mechanisms are inhibited.”

“The clinical evidence is overwhelming,” says Zeynep Sumer, a project manager in quality and patient safety at the Greater New York Hospital Association. In December 2007 the agency held a day-long program for advancing cerebral hypothermic resuscitation. Sumer invited Dr. Mayer to help organize the meeting, which included chief medical officer David Prezant, M.D., of the Fire Department of the City of New York.

A year later, after witnessing the benefits of cooling on out-of-hospital cardiac arrests, Dr. Prezant and his colleagues announced that ambulances will take these patients directly to a hospital that provides whole-body cooling, even if that means bypassing the nearest emergency room. The technology can cost upwards of \$30,000 per cooling machine and \$1,000 for the disposable cooling blankets. (Less expensive cooling solutions do exist, including cold saline solutions or plastic bags filled with ice.) Local New York hospitals are now scrambling to build cooling units in the emergency room. The program went into effect on January 1, 2009.

But the technique requires expertise and collaboration with emergency, cardiac, and neurology teams, says Dr. Mayer, who has helped develop the next generation of cooling equipment for a company called Medivance. He holds stock options in the company. Dr. Mayer says that he became passionate about cooling when he saw patients on the verge of death “walk out of the hospital with near-full recovery.”

Cooling is catching on in other cities as well, including Seattle and Dallas.

“This is tremendously important,” Dr. Mayer says. “What will change everything is when people facing this life-threatening emergency situation are aware of the cooling treatment, can ask for it, and can get it.”

Doctors may have to rethink what they have been taught about the oxygen-starved brain. “We were taught that brain cells die within five minutes of oxygen deprivation,” Dr. Mayer explains. “But we now suspect that there is a larger window, and that if patients are resuscitated quickly and the brain and body are cooled, it may minimize a cascade of secondary injury that plays out over many hours following the initial assault.”

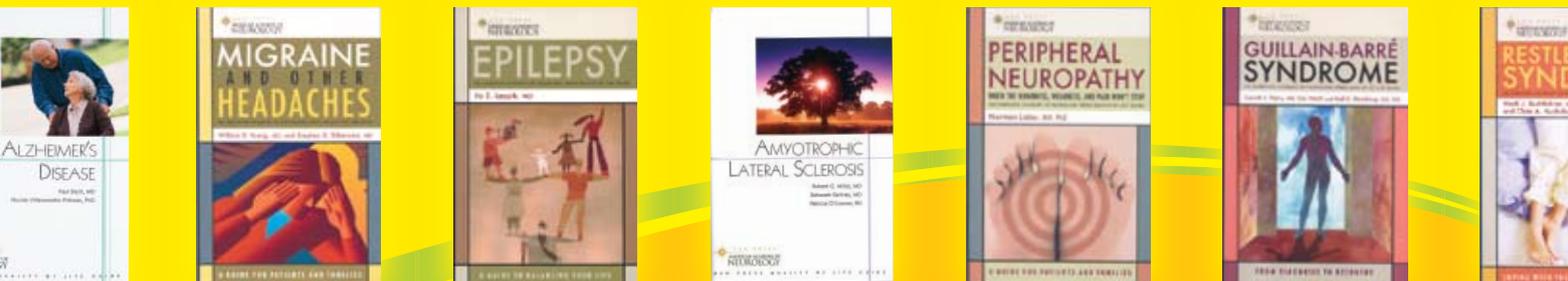


For now, many patients are thankful for the treatment. In October 2008, neurologist Syed Hasan Naqvi, M.D., had just finished exercising on his treadmill when he collapsed at his home on Long Island, NY. Luckily, his daughter heard the thump of his body. The ambulance arrived within minutes and he had to be shocked three times over 24 minutes before they got a pulse going. He was comatose by the time he arrived at Nassau Community Medical Center.

His wife remembered that a relative of theirs had done a residency at Columbia, where Dr. Mayer had recently given a talk on brain cooling. The relative called Dr. Mayer and they arranged for the transport, during which cooling packs were used. Five hours elapsed before an ambulance brought the neurologist to Dr. Mayer’s unit at Columbia. Not only was Dr. Naqvi in a coma, but he was rated a four on the Glasgow Coma Scale. The scale runs from three to 15, with three indicating a state of total unresponsiveness.

“I got there in the eleventh hour,” Dr. Naqvi says. Four days following the cooling, he emerged from his coma cognitively intact. “It is amazing,” he says. Six weeks after his brush with death, the movement disorders specialist was back at work part-time. “I was very lucky.”

Reliable Resources for Living Better



When you need information on living with a neurologic illness, you want a trustworthy source. Turn to the AAN Press, publisher of the award-winning *Neurology Now* magazine and the popular series of books on disorders of the brain and central nervous system.

Written for patients, their families, and caregivers by medical experts from the American Academy of Neurology, these books offer valuable information on causes, treatments, and how to improve the quality of life.

 www.aan.com/store

 (651) 695-2717 / (800) 879-1960

Knowledge Is Empowering

